THE EARLY DIAGNOSIS OF PULMONARY TUBERCULOSIS

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BY way of apology for introducing this familiar subject I put forward its tremendous importance. Its importance confronts us, as medical men, in the interests of medical science. Probably, also, it is the most important matter which is affecting the civilized world.

In dealing with the question, I shall attempt to coördinate the facts of pathology, symptoms, and clinical features, which are recognized as of the greatest value in accomplishing our object. The whole question of the pathology of pulmonary tuberculosis depends upon the channel of infection; and, after infection, of the means by which the disease is spread.

We agree that infection may be primarily by the air or by way of the blood; but the vast majority of cases of primary pulmonary tuberculosis are by way of the air through the lymph channels. The older view of Calmette, reviewed by Whitla, is, that the majority of cases are contracted not by inhalation but by the ingestion of bacilli or their products, which penetrate the intestinal mucosa. Whitla and Symmers conclude that the bacillus is carried through the lacteals to the thoracic duct, thence to the jugular vein, and through the heart to the capillaries of the lungs, where they are arrested. Ravenel believes that the commonest mode of entrance in the human subject, except in the case of young children, is by way of the tonsils and the lymphoid tissue of the pharynx.

In all probability tuberculosis is primarily a lymphatic process. If Ravenel is correct, the bacilli pass to the cervical glands; from them to the mediastinal and bronchial glands, and finally into the lung tissue, especially by way of the peribronchial lymphatics of the larger bronchi. From the root of the lung, the paths of infection may be outward towards the axilla to the middle part of the upper lobe, frequently passing to the surface, infecting the pleura, and so causing tuberculous pleurisy, which in turn may lead to a more or less widespread re-infection by way of the sub-pleural and interlobular lymphatics.

Again, infection may pass, not infrequently, to the upper part of the lower lobe. The most common path of infection appears to be outwards and upwards towards that part of the lung close to the verte-

bral column, and midway between the hylus and the apex. This is the usual site of chronic, primary tuberculosis. The explanation of the greater frequency of these foci in the paravertebral, cranial part of the lung is that the tubercle bacilli will grow better in this part, because there is the greatest opportunity for the accumulation of the virus wherever the respiratory movements are slightest. That is to say, if we should introduce at the same time into all the lymphatics of the lungs, the same number of bacilli, beginning with one, and if we should make equal increase, the first infection would arise in the paravertebral cranial parts. It would seem that the chance of infection is inversely proportional to the respiratory movements of the lymph.

If this explanation be a true one, it will also explain other phenomena which are characterisic of chronic, miliary tuberculosis of this region. For example, it will explain why the focus becomes chronic there. It commences from small quantities of virus, and if these foci coalesce, or, by opening into a bronchus, cause a broncho-pneumonic infection, the broncho-pneumonic foci will tend to enlarge before they break down. However, it is sufficient if we assume that the vast majority of cases of chronic, primary tuberculosis commence as a focus situated in the paravertebral, cranial part of the lung.

There is a strong tendency at the present day, in consideration of the frequency of tuberculosis among children, and the evidence of its slow development, to the view that infection takes place during childhood, and that a long period of latency may occur before physical signs or symptoms become apparent. Harbitz gives statistics on this subject, and points out the strong probability of infection in childhood, but admits that the morbid anatomist has not furnished proof of this. In an analysis of 1,000 consecutive autopsies, Adami and McCrae found obsolete or healed tuberculosis in 151 cases, and latent tuberculosis in 93 cases. Out of the 151 healed cases, 100 showed healed pulmonary tubercles, while, of the 93 latent cases, 72 were again pulmonary. Of the 100 healed cases, the site of lesion was the following: upper left, 56; upper right, 48; lower left, 8; lower right, 8; middle right, 5. Of the 72 latent pulmonary cases, single lesions in sites other than the apex were rare. The left lower lobe was affected four times; right lower, three times; right middle but once.

To quote the satistics which Adami and McCrae give regarding ulcerative pulmonary tuberculosis would be unnecessary, as it is our aim to consider this disease at a stage previous to that. The facts which are most striking in the above statistics are: (1) the predisposition to tuberculosis of the upper lobes; and (2) the rarity of single lesions of the lungs in a lower lobe. It would appear that the channels through

which the lower lobe is infected are the air passages and, rarely, the lymphatics.

We are led to conclude that the majority of cases of chronic, miliary tuberculosis affect the paravertebral cranial part of the lung. Chronic nodules in their naked appearance are characterized by a greater translucency than the more acute miliary forms, and a greater fibrous overgrowth surrounding the capsule, which extends into the lung tissue around it, and produces interstitial changes at some distance from the nodule. The centre of the area may be caseous. The microscopic appearance of these nodules is that of fibrous and cellular tissue, with caseation in the centre, and generally with definite giant cells at the periphery. These areas of caseation frequently ulcerate into a bronchus, forming cavities of various sizes. The bronchus becomes infected by tuberculous bronchitis, and its various bronchioles becoming infected, this leads too frequently to acute tuberculous broncho-pneumonia. Hæmorrhage may occur from one of these peribronchial nodules, when it takes an active form, and the bleeding or oozing be due to hyperæmia. Or, again, the nodule may rapidly soften and ulcerate, so as to form a communication between a bronchus and a branch of the pulmonary artery, or possibly the tributary of a vein. These are the usual causes of early hæmoptysis. But, a beginning focus, under certain circumstances, may develop into any form of pulmonary tuberculosis.

From what we have already considered, it naturally follows that in primary, pulmonary tuberculosis, it is common for the patient to have no apparent symptoms. It is remarkable how little discomfort many people find in various chronic diseases. When one remembers that the commonest initial count in pernicious anæmia is one million red blood cells, it is not strange that in this insidious disease symptoms should not be forthcoming.

Symptoms may be divided into two classes, (1) certain direct symptoms of lung mischief; (2) certain empirical symptoms. I wish at first to direct attention to certain empirical symptoms useful in early diagnosis. Subnormal temperature in the morning is very characteristic of early involvement. At Tranquille during the past summer I was struck with the fact that not infrequently this subnormal temperature on waking was associated with a more rapid pulse than in the evening. This phenomenon disappeared, however, as the patient became better nourished, and as the blood pressure improved. In all probability these symptoms go along with the loss of muscle and the lack of muscular tone which is so characteristic of tuberculous toxæmia. At the same time these individuals wear sweaters, chest protectors, mufflers, and such abominations, in order to make up for their low heat production.

Langour and even anorexia are probably like symptoms, and it would appear that defective hygiene plays a large part in their production.

Anæmia is of special importance in the case of girls and young women. I have seen a number of cases of chlorosis in girls working in the tweed mills in the south of Scotland, and the large amount of pulmonary tuberculosis was very striking. The persistence of the anæmia was oftentimes associated with the appearance of symptoms directly betraying lung mischief. We are accustomed to think of mitral stenosis as being associated with chlorosis, but I believe that chlorosis is more often associated with pulmonary tuberculosis than with mitral disease, and that it is not at all uncommon to find the three present. In British Columbia I have seen about forty cases of tuberculosis. Two of these were young men of twenty, presenting a fair amount of anæmia, with mitral stenosis, and fairly advanced tuberculosis of the lungs. It has been shown that in a series of cases of persisting chlorosis, seventy-five per cent. of those presenting no evidence whatever of tuberculosis gave the tuberculin reaction. These cases were not true chlorosis, as chlorosis does not occur in men. Zickgraf, who makes the above observation, believes that tuberculosis is responsible for a large number of cases of chlorosis. He recommends the tuberculin test to be used in refractory chlorosis.

An attack of *la grippe* is often a manifestation of pulmonary tuberculosis. The patient says that he had *la grippe* when he had, perhaps, a tuberculous auto-intoxication. Gastro-intestinal disturbance, nausea, discomfort, atony, call for chest examination; constipation and gastric disturbances are often due to the tuberculous toxin.

Circulatory enfeeblement is one of the earliest symptoms. It likely keeps pace with the loss of strength which has predisposed to the disease. Thus, the pulse tends to be accelerated and of low pressure, even in the early stages, with the heart presenting a limited area by percussion. On auscultation the first sound at the mitral area will be short and metallic in tone, as of a thin-walled ventricle.

These matters, with other evidence of failing strength, such as incapable chest with delicate bones, may have much to do with predisposition to the disease, because we have seen that the likelihood of deposit of the virus depends upon the flow of lymph in the lungs. Whether one takes to the asthenic or to the toxæmic explanation of these events matters little. On observing their effects, we should look for tuberculosis.

I wish to draw attention to those symptoms which are most commonly noticed by patients themselves. From statistics of cases at Tranquille from January 1st to April 30th, 1910, the symptoms which

induced them to consult their doctor were the following: cough, 67 per cent.; pleuritic cough, 2 per cent.; pain, 8 per cent.; hæmorrhage, 8 per cent.; languor, 6 per cent.; after enteric fever, 2 per cent.; loss of weight, 2 per cent.; asthma, 2 per cent.; pneumonia, 2 per cent. Hæmorrhage is the readiest cause for consulting the physician; next is pain; then cough with sputum. As cough is due either to irritation of the pleura, or to the breaking down of a tubercle causing a bronchitis, the sputum pausing and irritating at the bifurcation of the trachea, or the vocal cords, it follows that cough is usually a somewhat late symptom of the disease. In the majority of cases it requires ulceration for its determination.

Pleuritic pain may be an early symptom due to infection of the pleura by way of the subpleural lymphatics from a chronic nodule, or by a spread directly from the root of the lung. Hæmorrhage as an initial symptom is potentially the earliest of all, as it may come from hyperæmia, or from a very minute ulceration. It would appear, from the statistics at Tranquille, that pleuritic pain and hæmorrhage are more likely to go with early diseases, than symptoms which are not reckoned by the patient as of much importance.

With regard to the clinical features of chronic, miliary tuberculosis, it is also significant that there may be none noticeable. J. J. Galbraith gives statistics of 156 consecutive cases of which twenty-six per cent. manifested hæmoptysis with no physical signs. I do not wish to detract from the great value of inspection, palpation, mensuration of the chest, but I do not wish to deal with methods which may bring out nothing in very early cases. After having inspected the chest from the various points of view, and perhaps having suspicions raised by means of observations taken from palpation and mensuration, one usually passes to percussion. Although it has not the far reaching use of auscultation, percussion, theoretically and practically, is of great value in the diagnosis of very limited lesions. Remembering that the common site of a lesion is at a point midway between the hylus and the apex of the lung, along its vertical border, we instinctively direct our attention to this spot. In auscultation of this region, the bronchus coming near the surface in the right side, and being deeper on the left side, the respiratory murmur is distinctly altered, and may, especially in a patient with thin-walled chest, seem to warrant the diagnosis of infiltration at this spot on the right side. Furthermore, vocal fremitus is normally increased and vocal resonance is normally greater over the right apex behind.

Again, as I have endeavoured to point out, in the pathology of the disease, the pleura is very frequently affected and thickened, and thus again the respiratory murmur is modified. In this way, with an infiltra-

tion of the right apex involving and thickening the pleura, the respiratory murmur, the vocal resonance, and vocal fremitus may not appear in any way, or to any degree, altered, and may not warrant to the mind of the auscultator the diagnosis of a lesion. I am convinced of this from experience of *post mortem* examinations in hospital cases where a lesion was never anticipated, and it has been found that, in all probability, pleural thickening and adhesions over the right apex have covered up and rendered impossible the diagnosis. This condition is analagous to those cases of thickened and adherent pericardium which only appears to muffle and render indistinct the cardiac sounds in cases of chronic Bright's disease and general amyloid disease.

Percussion presents none of these difficulties in the lung, and when we use the tidal phenomenon, as a means of diagnosis, we have a precise method. With the patient sitting on a stool, we place the finger across the trapezius on a plane parallel to the mesial plane of the body. Comparing the note over the one trapezius with that of the other, we are given a general idea of the resonance in the vertical depth of the lung. The value of this precedure, and in fact of all modes of percussion, depends upon the degree in which the plexímeter finger is part of the vibrating surface. The finger must be firmly pressed into the trapezius so as to become part of the vibrating surface. Assuming that this procedure makes us suspicious of one side, we compare the resonance of each apex, and, more important, make a comparative test of the tidal value of each apex. Laying the finger parallel to the clavicle, we try to obtain resonance one inch and one-half to two inches above the clavicle. In deep inspiration this resonance should increase to the extent of half an inch on both sides in front and behind. In the pathology of this chronic disease, miliary in character, it was seen that although the nodule is commonly situated at a point some distance from the apex, it causes increase of fibrous tissue, and, in fact, a form of interstitial pneumonia all round it. Therefore, in an involved apex, the fibrous tissue determines the loss of the tidal movement. Percussion of the bases as well is of value to determine the tidal value of the lung. Furthermore, percussion, with varying degrees of strength of the blow, will often bring out slight degrees of dullness of an apex.

In conclusion, I wish to emphasize, (1) the lymphatic nature of the disease in its primary state; (2) the predisposition of the paravertebral cranial parts of the lung; (3) the rarity of single lesions in the lower lobes or bases of the lungs; and (4) the importance of percussion. I would also note the valuable use of the von Pirquet test in all questionable cases. It is an undoubted advance over the uncomfortable, subcutaneous injection with its accompanying fever.